

Appl. No. 10/687,947
Amdt. Dated December 9, 2005
Reply to Office Action of August 10, 2005

Attorney Docket No. 81863.0022
Customer No.: 26021

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Withdrawn) An actuator comprising a substrate and displacement element disposed on the surface of said substrate, said displacement element comprising a piezoelectric ceramic layer and a pair of electrodes interposing therebetween said piezoelectric ceramic layer, said piezoelectric ceramic layer and said substrate having as their principal component a perovskite crystal containing at least Pb, Zr and Ti, the maximum difference in composition ratio Pb/(Ti+Zr) between the surface of said piezoelectric ceramic layer and the inside of said substrate being 0.02 or less, and the entire thickness of said actuator being 100µm or less.

2. (Withdrawn) The actuator according to claim 1 wherein a plurality of said displacement elements are disposed on the surface of said substrate.

3. (Withdrawn) The actuator according to claim 1 wherein the porosities of said substrate and said piezoelectric ceramic layer are 1 % or less.

4-8. (Cancelled).

9. (Withdrawn) A printing head comprising a passage member having a plurality of ink passages, and an actuator according to claim 1 which is disposed on said passage member, ink charged in said ink passage being discharged by the displacement of said displacement element constituting said actuator.

10. (Cancelled)

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11. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein said perovskite compound is a lead zirconate titanate-based compound.

12. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein said piezoelectric ceramic layer contains at least one selected from Sr, Ba, Ni, Sb, Nb, Zn and Te.

13. (Currently Amended) The actuator according to claim ~~12~~ 19 wherein said piezoelectric ceramic layer contains Ba in an amount of 0.02 to 0.08 mol, and Sr in amount of 0.02 to 0.12 mol.

14. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein said piezoelectric ceramic layer contains Pb exceeding the amount of Pb required from the stoichiometric ratio of said perovskite compound, and the excess ratio at site A is 1.005 to 1.04.

15. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein said ceramic substrate is a piezoelectric element.

16. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein a constraint part is bonded via an adhesive layer to a part of said ceramic substrate, and displacement occurs at a non-constraint part.

17. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein the magnitude of d_{31} is 200 pm/V or more.

18. (Currently Amended) The actuator according to claim ~~10~~ 19 wherein elastic compliance is $14.0 \times 10^{-12} \text{ m}^2/\text{N}$ or less.

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19. (Currently Amended) ~~The actuator according to claim 10~~ An actuator comprising a ceramic substrate and a plurality of displacement elements disposed on the surface of said substrate, said displacement elements comprising a piezoelectric ceramic layer and a pair of electrodes interposing therebetween said piezoelectric ceramic layer, said piezoelectric ceramic layer comprising a perovskite compound containing Pb, Zr and Ti, the lattice constant ratio c/a of said perovskite compound being 1.013 to 1.016, said actuator having a thickness of 100µm or less
wherein the maximum difference in composition ratio Pb/(Ti+Zr) between the surface of said piezoelectric ceramic layer and the inside of said ceramic substrate is 0.02 or less.

20. (Currently Amended) A printing head comprising a passage member having a plurality of ink passages, and an actuator according to claim ~~10~~ 19 which is joined onto said passage member such that displacement element constituting said actuator is located immediately above said ink passage, ink charged in said ink passage being discharged by the displacement of said displacement element.

21-25. (Canceled).